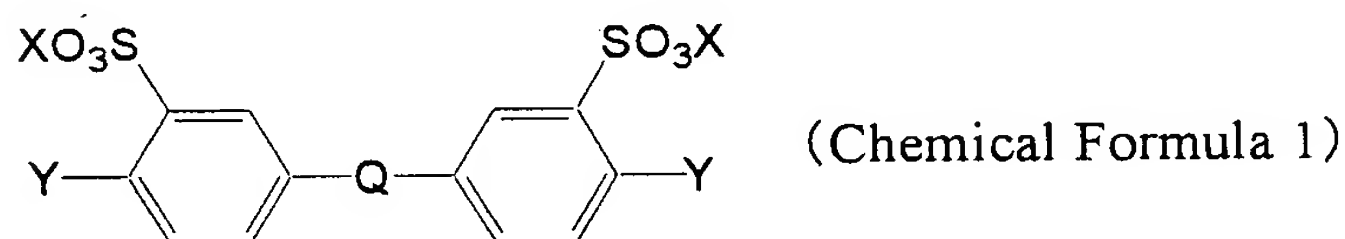# CLAIMS

1. A composite ion exchange membrane comprising an ion exchange resin composition, and a support membrane having a continuous pore penetrating the support membrane, wherein

said support membrane is a support membrane which accepts said ion exchange resin composition within said pore, and
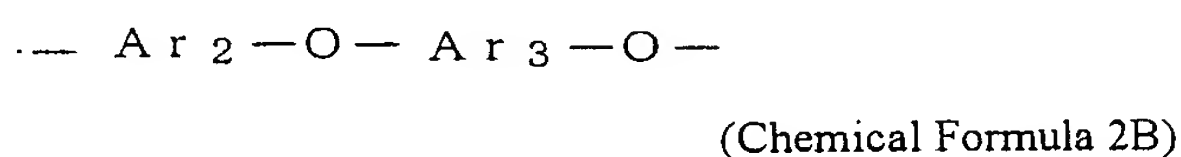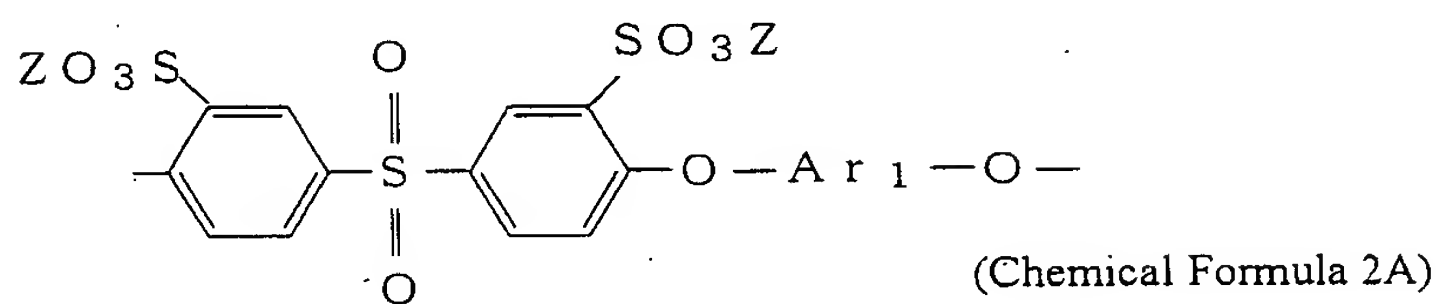
said ion exchange resin composition is an ion exchange resin composition which contains an ion exchange resin containing, as a main component, an aromatic polyether and/or its derivative, the aromatic polyether being obtained by mixing a monomer component which contains, as main ingredients, a compound represented by Chemical Formula 1, an aromatic dihalogenated compound and a bisphenol compound with a carbonate and/or a bicarbonate of an alkali metal and polymerizing the mixture in an organic solvent:

(Chemical Formula 1)

(in Chemical Formula 1, Q represents a $-S(=O)_2-$ group or a $-C(=O)-$ group; X represents an H atom, an Li atom, an Na atom or a K atom; and Y represents an F atom, a Cl atom, a Br atom or an I atom).

2. A composite ion exchange membrane comprising an ion exchange resin composition, and a support membrane having a continuous pores penetrating the support membrane, wherein said support membrane is a support membrane which accepts said ion exchange resin composition within said pore, and said ion exchange resin composition is an ion exchange resin composition which contains an ion exchange resin including linking units represented by Chemical Formula 2A and linking units
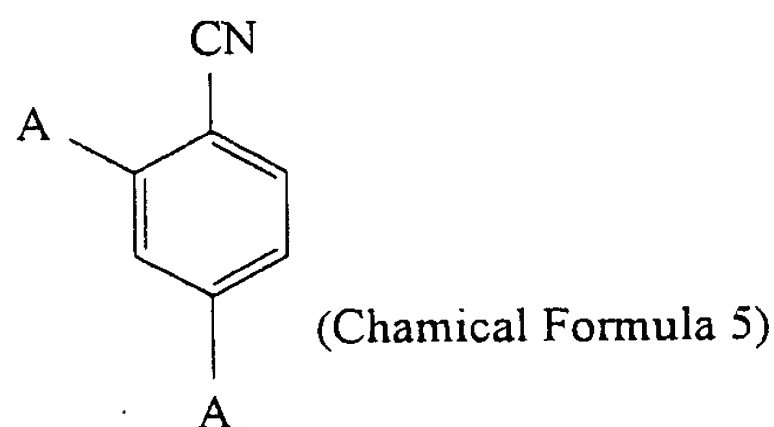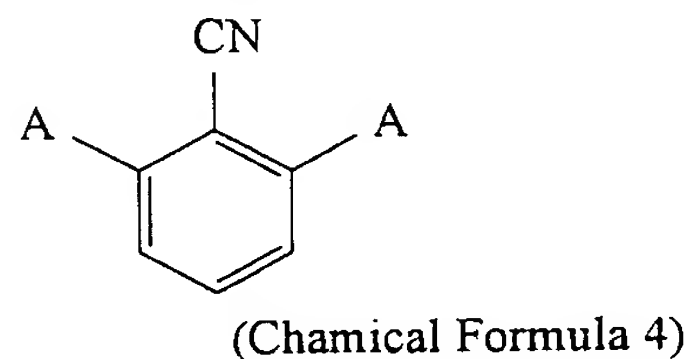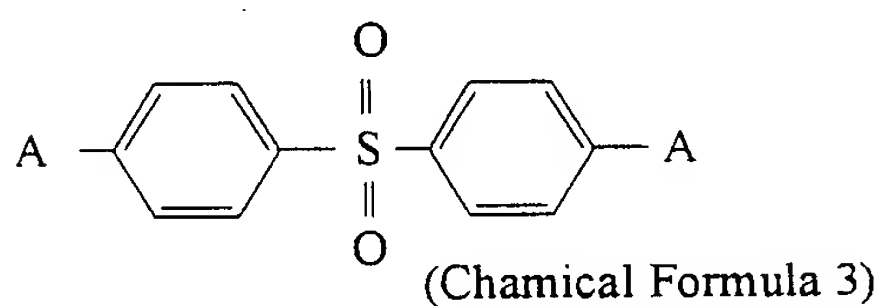
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represented by Chemical Formula 2B at a ratio, Chemical Formula 2A : Chemical Formula 2B = n : m, respectively:

$$ZO_3S \overbrace{} \quad \underset{O}{\overset{O}{\underset{\parallel}{\overset{\parallel}{S}}}} \quad \overbrace{}^{SO_3Z} O - Ar_1 - O -$$

(Chemical Formula 2A)

$$— Ar_2 - O - Ar_3 - O —$$

(Chemical Formula 2B)

(in Chemical Formulas 2A and 2B, Z represents H, Li, Na, K or a cation derived from an aliphatic or aromatic amine; Ar_1 and Ar_3 independently represent one or more kinds of bivalent organic group; Ar_2 represents one or more kinds of bivalent organic group including an aromatic ring having an electron-withdrawing group; and n and m represent an integer within a range of 1 to 1000 and an integer within a range of 0 to 1000, respectively).
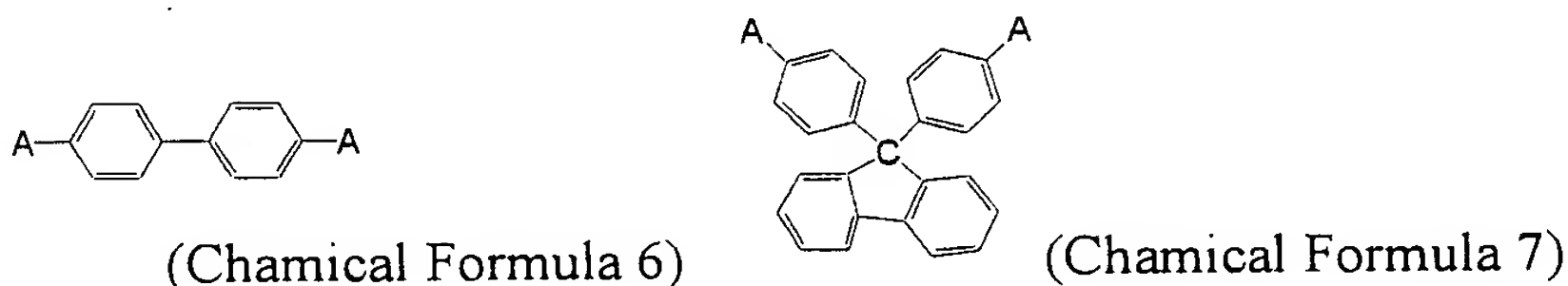
3. The composite ion exchange membrane according to claim 2, wherein said Ar_2 is one or more kinds of linking unit selected from the group consisting of linking units represented by Chemical Formula 3, Chemical Formula 4 and Chemical Formula 5:

$$A - \overbrace{} - \underset{O}{\overset{O}{\underset{\parallel}{\overset{\parallel}{S}}}} - \overbrace{} - A$$

(Chamical Formula 3)

$$A \overbrace{}^{CN} A$$

(Chamical Formula 4)

$$A \overbrace{}^{CN} \\ A$$

(Chamical Formula 5)

(in Chemical Formulas 3 to 5, A represents in each occurrence a linking site with another linking unit).

4. The composite ion exchange membrane according to claim 2, wherein said Ar_1 and said Ar_3 each are one or more kinds of linking unit selected independently from the group consisting of linking units represented by Chemical Formula 6 and Chemical Formula 7:

(Chamical Formula 6)   (Chamical Formula 7)

(in Chemical Formula 6 and Chemical Formula 7, A represents in each occurrence a linking site with another linking unit).

5. The composite ion exchange membrane according to claim 2, wherein said Ar_1 and said Ar_3 each are a linking unit represented by said Chemical Formula 6, said Ar_2 is a linking unit represented by said Chemical Formula 3, and said n and said m each are an integer within a range of 1 to 1000 which satisfies Mathematical Expression 1:

$0.2 \leq n/(n + m) \leq 0.8$ (Mathematical Expression 1).

6. The composite ion exchange membrane according to claim 2, wherein said Ar_1 and said Ar_3 each are a linking unit represented by said Chemical Formula 6, said Ar_2 is a linking unit represented by said Chemical Formula 4, and said n and said m each are an integer within a range of 1 to 1000 which satisfies Mathematical Expression 2:

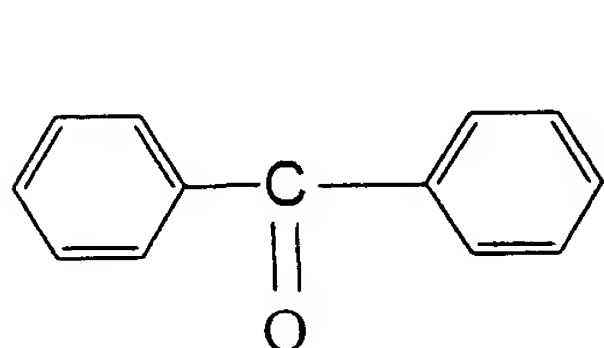$0.2 \leq n/(n + m) \leq 0.8$ (Mathematical Expression 2).

7. The composite ion exchange membrane according to claim 2, wherein said Ar_1 and said Ar_3 each are a linking unit represented by said Chemical Formula 7, said

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Ar$_2$ is a linking unit represented by said Chemical Formula 3, and said n and said m each

are an integer within a range of 1 to 1000 which satisfies Mathematical Expression 3:

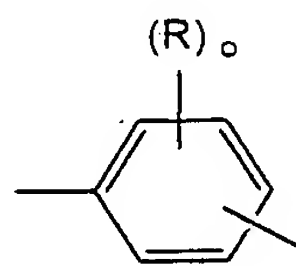$0.3 \leq n/(n + m) \leq 0.7$ (Mathematical Expression 3).

5   8.   The composite ion exchange membrane according to claim 1, wherein said

ion exchange resin composition contains a crosslinked ion exchange resin obtained by

crosslinking an ion exchange resin having an ionizable group in the molecule and also

having a photocrosslinkable group and/or a thermally crosslinkable group in the

molecule.

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     9.   The composite ion exchange membrane according to claim 8, wherein said

photocrosslinkable group contains both a crosslinkable group having a chemical

structure represented by Chemical Formula 8 and a crosslinkable group having a

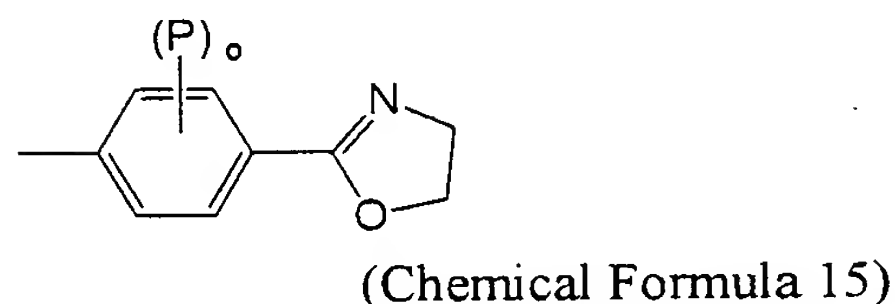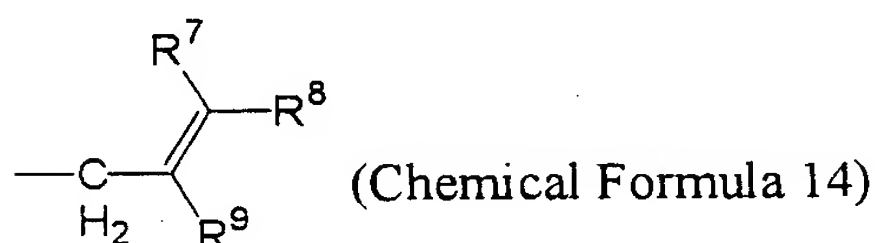chemical structure represented by Chemical Formula 9:
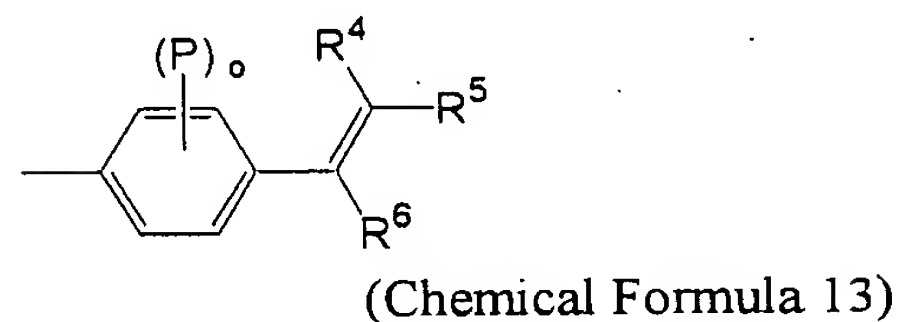

(Chemical Formula 8)   (Chemical Formula 9)

15

(in Chemical Formula 8 and Chemical Formula 9, R represents an aliphatic

hydrocarbon group with a carbon number within a range of 1 to 10; and o represents an

integer within a range of 1 to 4).

20   10.   The composite ion exchange membrane according to claim 8, wherein said

thermally crosslinkable group is one or more kind selected from the group consisting of

the thermally crosslinkable groups of chemical structures represented by Chemical
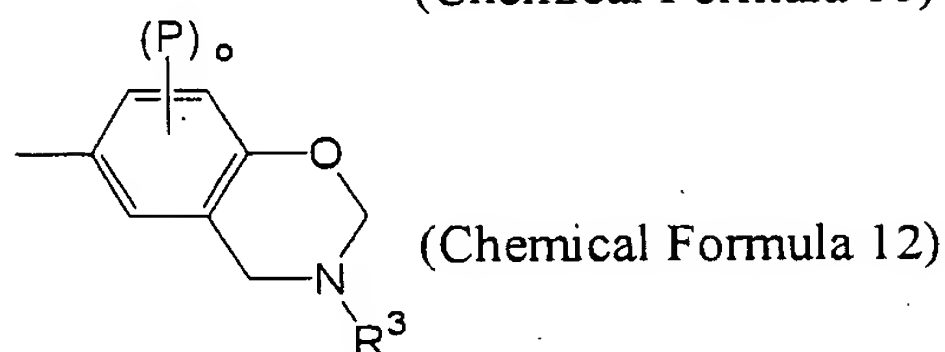
Formulas 10 to 15:

(Chemical Formula 10)

$-C{\equiv}C-R^1$ attached to phenyl ring with $(P)_o$

(Chemical Formula 11)

$-O-\underset{H_2}{C}-C{\equiv}C-R^2$ attached to phenyl ring with $(P)_o$

(Chemical Formula 12)

benzoxazine ring with $(P)_o$, O, N–R^3

(Chemical Formula 13)

$-\underset{R^6}{\overset{R^4}{C}}=C-R^5$ attached to phenyl ring with $(P)_o$

(Chemical Formula 14)

$-\underset{H_2}{C}-\underset{R^9}{\overset{R^7}{C}}=C-R^8$

(Chemical Formula 15)

oxazoline ring attached to phenyl ring with $(P)_o$, N, O

(in Chemical Formulas 10 to 15, R^1 to R^9 each independently represent a hydrogen atom, an alkyl group with a carbon number within a range of 1 to 10, a phenyl group, an aromatic group with a carbon number within a range of 6 to 20 or a halogen atom; P represents a hydrogen atom, a hydrocarbon group with a carbon number within a range of 1 to 10, halogen, a nitro group or a $-SO_3T$ group; T represents an H atom or a monovalent metal ion; and o represents an integer within a range of 1 to 4).

11. The composite ion exchange membrane according to any one of claims 1 to 10, which has a surface layer comprising said ion exchange resin composition on each side of said support membrane.

12. The composite ion exchange membrane according to claim 11, wherein the thickness of each of said surface layers is within a range of 1 to 50 μm and also is within a range which does not exceed half the total thickness of said composite ion exchange membrane.

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13. The composite ion exchange membrane according to claim 11, wherein at least one surface of said support membrane has an aperture ratio within a range of 40 to 95%.

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14. The composite ion exchange membrane according to claim 11, wherein said support membrane contains a polybenzazole-type polymer as a material.

15. The composite ion exchange membrane according to claim 12, wherein said support membrane contains a polybenzazole-type polymer as a material.

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16. The composite ion exchange membrane according to claim 13, wherein said support membrane contains a polybenzazole-type polymer as a material.

17. The composite ion exchange membrane according to claim 14, wherein

15 said support membrane is obtained by shaping an isotropic solution containing said polybenzazole-type polymer in a content within a range of 0.5 to 2% by mass into film and then solidifying the solution.

18. The composite ion exchange membrane according to claim 1 or 2, wherein

20 when a straight line running through the composite ion exchange membrane along its thickness direction is set in an analysis area in a cross section of said composite ion exchange membrane and a linear analysis for elements contained only in the ion exchange resin is conducted using an electron probe microanalyzer, the variation in the number of X-ray counted, as indicated in CV value, is within 50%.

25

19. The composite ion exchange membrane according to claim 1 or 2, wherein when a straight line running through the composite ion exchange membrane along its thickness direction is set in an analysis area in a cross section of said composite ion

exchange membrane and a linear analysis for elements contained only in the ion exchange resin is conducted using an electron probe microanalyzer, the number of the analysis points where the number of the counted X-rays of the analyzed elements is 5% or less relative to the maximum number is within a range of 0 to 30% of the number of

5   all the analysis points.